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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
ROSENBERGER, FREDERICK F	
ART UNIT	**PAPER NUMBER**
2878	

DATE MAILED: 08/12/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/688,723	MAY, RANDY DEAN	
	Examiner	Art Unit	
	Frederick F. Rosenberger	2878	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *03 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 June 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *6/3/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The amendment filed on June 3rd, 2005 has been entered. Accordingly, amendments have been made to the drawings, the specification, and the claims. Claims 1-20 are now pending in this application.

2. The drawings were received on June 3rd, 2005. These drawings are acceptable.

Claim Objections

3. Claims 10 and 13 are objected to because of the following informalities: In amended claim 10, line 1, "level" should be deleted. In amended claim 13, line 6, "light from emitted from said light source" should be --light emitted from said light source--. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 5, 10, 13, and 18 are rejected under 35 U.S.C. 102(e) as being anticipated by Lievois et al. (US Patent # 6,292,756).

Lievois et al. disclose a method and system capable of detecting water vapor in natural gas comprising:

A light source **94** (Figure 4) emitting light at substantially a single wavelength corresponding to a single absorption line at which water molecules absorb light at a substantially greater level than natural gas molecules (column 5, lines 5-8 and column 11, lines 33-36);

An InGaAs detector **96** (Figure 4 and column 6, lines 11-13) configured to detect the intensity of light emitted from the light source, wherein natural gas is allowed to flow past the detector **96** and the source **94** through a pipe **83** (Figure 4);

And electronics, in the form of flow computer **66** (Figure 3 and column 5, lines 44-47) coupled to the detector **96** through signal conditioning circuit **68** for determining the level of water vapor in the gas flow.

6. Claims 1, 2, 5, 6, 10, 13, 17, 18, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Kessler et al. (Conference Paper entitled "Near-IR diode laser-based sensor for ppb-level water vapor in industrial gases").

Kessler et al. disclose a system for detecting trace amounts of water vapor in natural gas (see abstract, line 11) comprising:

A light source, in the form of a tunable diode laser (page 144, section 2.1), emitting light at substantially a single wavelength corresponding to a single absorption

line at which water molecules absorb light at a substantially greater level than natural gas molecules;

A detector, in the form of an InGaAs photodiode (page 144, section 2.1), configured to detect the intensity of light emitted from the light source;

Electronics, in the form of computer module and data acquisition unit (page 144, section 2.2) coupled to said detector for determining the level of water vapor in the natural gas;

A means for calibration of the system relative to known concentrations of water vapor (pages 145-146, section 4);

A mulitpass Herriott cell (page 144, section 2.3);

And a means for supplying a flow of natural gas to the Herriott cell and thus across the light source.

7. Claims 1, 3, and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Cvetkovic (German Patent Publication # DE-3413914-A1).

Cvetkovic discloses a system for detecting trace amounts of water vapor in natural gas (see applicant submitted English translation, page 3, lines 30-33) comprising:

A light source, in the form of color center laser **1** (Figure 1), emitting light at substantially a single wavelength corresponding to a single absorption line at which water molecules absorb light at a substantially greater level than natural gas molecules (applicant submitted English translation, page 3, lines 30-33 and lines 45-47).

A detector **10** (Figure 1) configured to detect the intensity of light emitted from the light source; and

Electronics **7** (Figure 1 and applicant submitted English translation, page 4, lines 36-37) coupled to the detector for determining the level of water vapor in the natural gas.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 2-4 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lievois et al., as applied to claim 1 above, and further in view of Inman et al. (US Patent # 6,188,475).

Lievois et al. disclose all of the elements of the parent claim 1, as described above. However, Lievois et al. are silent with regards to the limitations of claim 2-4, wherein the source is a specific laser type. Lievois et al. only disclose a light emitting diode.

Inman et al. teach an in-line cell for absorption spectroscopy that employs a diode laser source to emit light at a wavelength characteristic of the impurity within the sample gas (column 6, lines 63-67). For the light source, Inman et al. employ a laser

diode or other suitably sized tunable lasers, such as fiber lasers or quantum cascade lasers.

It would have been well known to a person having ordinary skill in the art at the time of the invention that laser diodes are preferential for their narrow emission spectrum and beam width compared to LED devices, as used by Lievois et al. Such a characteristic would be desirable, as narrow emitted bandwidth would excite only the impurity and not the sample gas, resulting in less noise and more reliable measurement. It would have been further evident that selection of the particular laser, whether a diode laser, color center laser, or quantum cascade laser, would be predicated on size and cost issues. From the viewpoint of performance within the context of the invention, use of a diode laser, color center laser, or quantum cascade laser as the light source, per the limitations of claims 2-4, would be functionally equivalent.

Thus, it would have been obvious for a person having ordinary skill in the art to modify Lievois et al. such that LED light source is replaced with a diode laser or similar laser source to provide a narrower emission spectrum for efficient detection of water within a gas flow, as taught by Inman et al.

10. Claims 6-9, 11, and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lievois et al., as applied to claim 1, 10, and 13 above, and further in view of Murray, Jr. et al. (US Patent # 5,107,118).

Lievois et al. disclose all of the elements of the parent claims 1 and 10, as discussed above. However, Lievois et al. are silent with regards to the additional

limitation of claim 6, wherein calibration means are provided for calibrating the detector based on known concentrations of water vapor in the sample gas. Although calibration methods are implied (column 7, lines 1-8 and column 11, lines 45-52), Lievois et al. do not specifically mention calibration methodology with known water vapor content in a sample gas.

Murray, Jr. et al. teach measurement of water levels in hydrocarbon media such as natural gas using absorption of a light radiation at a given wavelength by the water. Murray, Jr. et al. further teach a calibration method compatible with such an absorption based measurement system wherein a calibration curve is constructed based on the detected signal for various known water content samples (column 7, lines 5-8 and 15-20).

Thus, it would have been obvious for a person having ordinary skill in the art to modify Lievois et al. to include calibration means based on the known water content in the sample gas to enhance the accuracy of the absorption based method, as taught by Murray, Jr. et al. (column 7, lines 26-28).

Lievois et al. are further silent with regards to the limitations of claims 7-9, wherein the laser operates within specific wavelength ranges. Lievois et al. only discuss a wavelength of 1450nm for water vapor detection (column 11, lines 33-36), although Lievois et al. do allow for other wavelengths within the near to mid infrared region that act similarly to the wavelength at 1450nm (column 11, lines 41-43).

Murray, Jr. et al. teach that the desired wavelength range for the absorption based measurement of water vapor in a sample gas is 2710nm to 2747nm, to allow for

adequate differentiation between absorption due to water and due to the sample hydrocarbon gas (column 6, lines 32-38).

Thus, it would have been obvious for a person having ordinary skill in the art to modify Lievois et al. to use a wavelength range of 2710nm to 2747nm for the emitted wavelength of the laser source so as to provide adequate discrimination between the host natural gas and the contaminant water, as taught by Murray, Jr. et al. It would have been further obvious to one of ordinary skill in the art at the time the invention was made to use either of wavelength ranges specified in claims 7 and 9, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

11. Claims 12 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lievois et al., as applied to claim 1 and 13 above, and further in view of Brand et al. (US Patent # 6,064,488) and Lehmann (US Patent # 5,528,040).

Lievois et al. disclose the limitations for the light source, detector, and electronics, as discussed above in regards to claim 1. Lievois et al. further detail the use of a supply line (Figure 1, between boxes **104** and **106**; column 3, lines 63-67) to provide a gas supply to the gas sensor. However, Lievois et al. are silent with regards to the gas sensor including a Herriott cell with two opposing mirrors.

Brand et al. teach the use of a Herriott cell **16** (Figure 1) with two opposing mirrors **26**, **27** (Figure 1) in an in-situ gas concentration measurement apparatus employing a tunable diode laser.

Lehmann discloses that in absorption spectroscopy, multiple path length optical cells are often used to increase detection sensitivity of trace species in the sample gas (column 4, lines 54-59), often taking the configuration of a White cell or a Herriott cell or variation thereof (column 4, lines 59-61). Further, when using a laser source, the Herriott cell configuration is preferable over White cells for its decreased sensitivity to mechanical vibration and convection effects (column 3, lines 3-11).

Thus it would have been obvious to a person having ordinary skill in the art to modify Lievois et al. to include a Herriott cell for increased detection sensitivity of trace amounts of water vapor in the natural gas sample with minimal noise effects from external variables, as taught by Brand et al. and Lehmann.

Lievois et al. are further silent with regards to the sampling shelter for housing the gas sensor.

Brand et al. teach that the apparatus for sensing gas concentrations via gas absorption spectroscopy is housed within enclosure **40** (Figure 2 and column 3, lines 56-60), thus acting as a sampling shelter for attaching the sensor system to the wall **39** (Figure 2) of a stack or pipeline.

Thus it would have been obvious to a person having ordinary skill in the art to provide the sensor system of Lievois et al. in a sampling shelter to protect the sensor

and allow it to connect to the pipeline of interest for sampling the gas under test, as taught by Brand et al.

12. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lievois et al., as applied to claim 1 above, and further in view of Paige (Conference paper entitled "Commercial gas sensing with vertical cavity lasers").

Lievois et al. disclose all the limitations of parent claim 1, as discussed above. However, Lievois et al. are silent with regards to the use of a VCSEL, or vertical cavity laser, as the light source.

Paige teaches that VCSELs are superior for gas sensing applications because of their wider tuning range, less divergence and rounder beam profile, as well as decreased susceptibility to optical feedback (page 141, first paragraph).

Thus, it would have been obvious for a person having ordinary skill in the art at the time the invention was made to modify Lievois et al. to include a VCSEL for the light source to take advantage of the VCSEL's wider tuning range, lower divergence, rounder beam profile, and decreased susceptibility to optical feedback, as taught by Paige.

Terminal Disclaimer

13. The terminal disclaimer filed on June 3rd, 2005 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US Patent Number 6,657,198 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Response to Arguments

14. Applicant's amendments to the specification, drawings, and claims have overcome the objections detailed in paragraphs 3-8 of the Office action dated April 12th, 2005. As such, these objections have been withdrawn.

15. Applicant's arguments filed June 3rd, 2005 have been fully considered but they are not persuasive.

Applicant has amended the claims to include the additional limitation that the light source emits light at substantially a single wavelength corresponding to a single absorption line at which water molecules absorb light at a substantially greater level than natural gas molecules.

Applicant argues that Lievois et al. operate in a liquid hydrocarbon phase for the measurement of the water phase (page 10, last paragraph through page 11, the first half of the first full paragraph). However, it is noted that Lievois et al. actually describe two different applications for their invention, namely the measurement of water in a liquid hydrocarbon phase and the measurement of water in a natural gas phase (see column 4, lines 50-60). While the natural gas measurement may occur in the presence of some liquid hydrocarbon, the amount is miniscule compared to the natural gas phase (see column 4, lines 5-11). Lievois et al. specifically choose the light source emission wavelength to avoid confusing the hydrocarbon condensate for the water phase in the natural gas measurement (see column 11, lines 31-33).

Applicant further argues that single line spectroscopy using an LED source is not possible and that an LED does not meet the limitations of the amended claim for a light source emitting light at substantially a single wavelength (page 11, middle of the first full paragraph through the end of the page). While an LED source might not be sufficient to perform single line spectroscopy in the context of this invention, the limitation that the source has a sufficiently narrow bandwidth for single line spectroscopy is not specifically recited in the claims. Further, while the use of the term substantially is not indefinite, it has been held to be a broad term (see MPEP 2173.05(b), subheading D regarding "substantially"). Absent any guidance from the specification, an LED source can be interpreted to have a sufficiently narrow bandwidth to qualify as emitting light at substantially a single wavelength.

Applicant may point out that the specification teaches away from the use of LED sources and towards laser sources (see, for example, page 4, lines 14-17). Applicant is reminded that while the claims are interpreted in light of the specification, limitations from the specification cannot be read into the claims. Further, applicant has only referred to the use of laser sources in the present invention and has not provided any guidance in the specification as to the appropriate bandwidth for the source that would constitute light emission at substantially a single wavelength.

Conclusion

16. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frederick F. Rosenberger whose telephone number is 571-272-6107. The examiner can normally be reached on Monday-Friday 7:30 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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